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PATENT APPLICATION

ATTORNEY DOCKET NO. 200316548-1

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Randy L. Hoffman, et al.

Application No.: 10/799,838

Filing Date: March 12, 2004

Confirmation No.: 8516

Examiner: Long Pham

Group Art Unit: 2814

Title: SEMICONDUCTOR DEVICE

Mail Stop Appeal Brief-Patents
Commissioner For Patents
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Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on 06/13/2006.

The fee for filing this Appeal Brief is (37 CFR 1.17(c)) $500.00.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

☐ (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d)) for the total number of months checked below:

☐ 1st Month $120	☐ 2nd Month $450	☐ 3rd Month $1020	☐ 4th Month $1590

☐ The extension fee has already been filed in this application.

☒ (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account 08-2025 the sum of $ 500. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees. A duplicate copy of this sheet is enclosed.

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Respectfully submitted,
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Docket No.: 200316548-1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	10/799,838
Appellants:	:	Randy L. Hoffman, et al
Filed:	:	March 12, 2004
TC/A.U.	:	2814
Examiner:	:	Long Pham
Title:	:	Semiconductor Device

APPEAL BRIEF

MS APPEAL BRIEF-PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir or Madame:

This brief is presented under 37 CFR § 41.37 in support of an appeal from a Final Office Action of May 17, 2006 regarding the above-identified application. Notice of the Appeal was filed under 37 CFR § 41.31 on June 13, 2006. This brief is accompanied by the fee set forth in 37 CFR § 41.20(b)(2), as described in the accompanying TRANSMITTAL OF APPEAL BRIEF.

I. REAL PARTY IN INTEREST

The real parties in interest for this appeal are:

A. The Hewlett Packard Development Company, LP, a limited partnership established under the laws of the State of Texas having a principal place of business in Houston, TX, the assignee of the application, and a subsidiary of the Hewlett Packard Company; and

B. The Hewlett Packard Company, a corporation established under the laws of the State of Delaware and having a principle place of in Palo Alto, California.

II. RELATED APPEALS AND INTERFERANCES

The related application number 10/799,961 is presently under appeal. The application was filed on March 12, 2004, with the title "Semiconductor Device". The first listed inventor is Randy L. Hoffman. The Primary Examiner is Long Pham of Art Unit 2814.

The related application number 10/799,325 is also presently under appeal. The application was filed on March 12, 2004, with the title "Semiconductor Device". The first listed inventor is Randy L. Hoffman. The Primary Examiner is Thien F. Tran of Art Unit 2811.

III. STATUS OF CLAIMS

A. Total Claims: 1-67

B. Current Status of Claims:

1. Claims canceled: none

2. Claims withdrawn: 15-32, and 42-56

3. Claims pending: 1-14, 33-41, and 57-67

4. Claims allowed: none

5. Claims rejected: 1-14, 33-41, and 57-67

6. Claims objected to: none

C. Claims on Appeal: 1-14, 33-41, and 57-67

IV. STATUS OF AMENDMENTS

Appellant has not filed any amendment to the application subsequent to the Final Office Action.

V. SUMMARY OF CLAIMED SUBJECT MATTER

A. Independent claim 1

Independent claim 1 recites a semiconductor device including a drain electrode, a source electrode, a channel contacting the drain electrode and the source electrode, and a gate dielectric positioned between a gate electrode and the channel. (Page 3, line 1, through page 4, line 24; page 5, lines 21-25; page 12, lines 1-9; page 15, lines 5-7 and 15-17; page 16, lines 9-12; page 20, lines 13-20; page 23, lines 23-25; and Figures 1A-1F, 2, and 3). With regard to the channel, the channel includes one or more compounds of the formula $A_xB_xC_xO_x$, wherein each A is selected from the group of Zn, Cd, each B is selected from the group of Ga, In, each C is selected from the group Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and each of A, B, and C are different from each other and from O. (Page 1, line 24, through page 2, line 6; page 6, line 1, through page 8, line 6; page 12, lines 11-25; page 15, lines 19-31; and page 16, lines 12-28).

Independent claim 1 is argued together with dependent claims 2-10.

1. Claim 3 is a dependent claim from independent claim 1 and recites that the one or more compounds of the formula $A_xB_xC_xO_x$ includes D_x, to form a compound of the formula $A_xB_xC_xD_xO_x$, where each D is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and where each of A, B, C, and D are different. (Page 1, line 24, through page 2, line 6; page 6, line 1, through page 7, line 17; page 8, lines 8-29; and page 12, lines 11-25).

2. Claim 5 is a dependent claim from dependent claim 3 and recites that the one or more compounds of formula $A_xB_xC_xD_xO_x$ includes E_x, to form a compound of the formula $A_xB_xC_xD_xE_xO_x$, where each E is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and where each of A, B, C, D, and E are different. (Page 1, line 24, through page 2, line 6; page 6, line 1, through page 7, line 17; page 8, line 31, through page 9, line 19; and page 12, lines 11-25).

3. Claim 7 is a dependent claim from dependent claim 5 and recites that the one or more compounds of formula $A_xB_xC_xD_xE_xO_x$ includes F_x, to form a compound of the formula $A_xB_xC_xD_xE_xF_xO_x$, where each F is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb,, each O is atomic oxygen, each x is independently a non-zero integer, and where each of A, B, C, D, E, and F are different. (Page 1, line 24, through page 2, line 6; page 6, line 1, through page 7, line 17; page 9, line 21, through page 10, line 10; and page 12, lines 11-25).

4. Claim 9 is a dependent claim from dependent claim 7 and recites that the one or more compounds of the formula $A_xB_xC_xD_xE_xF_xO_x$, includes

G_x, to form a compound of the formula $A_xB_xC_xD_xE_xF_xG_xO_x$, where each G is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb,, each O is atomic oxygen, each x is independently a non-zero number, and where each of A, B, C, D, E, F, and G are different. (Page 1, line 24, through page 2, line 6; page 6, line 1, through page 7, line 17; page 10, line 12, through page 11, line 2; and page 12, lines 11-25).

B. Independent claim 12

Independent claim 12 recites a semiconductor device including a drain electrode, a source electrode, a means for a channel to electrically couple the drain electrode and the source electrode, and a gate electrode separated from the channel by a gate dielectric. (Page 3, line 1, through page 4, line 24; page 5, lines 21-25; page 12, lines 1-9; page 15, lines 5-7 and 15-17; page 16, lines 9-12; page 20, lines 13-20; page 23, lines 23-25; and Figures 1A-1F, 2, and 3). With regard to the means for the channel, the means includes one or more compounds of the formula $A_xB_xC_xO_x$, wherein each A is selected from the group of Zn and Cd. (Page 6, lines 29-30; page 7, lines 19-21 and 30-31; page 12, lines 11-17; page 16, lines 12-18; and page 21, lines 1-4).

Independent claim 12 is argued together with dependent claim 14.

C. Independent claim 33

Independent claim 33 recites a semiconductor device formed by steps that include providing a drain electrode, providing a source electrode, providing a precursor oxide composition, depositing a channel including the precursor composition to form a multicomponent oxide including $A_xB_xC_xO_x$ from the precursor composition to electrically couple the drain electrode and the source

electrode, providing a gate electrode, and providing a gate dialectic positioned between the gate electrode and the channel. (Page 3, line 1, through page 4, line 24; page 5, lines 21-25; page 12, lines 1-9; page 15, lines 5-7, 15-17, and line 19, through page 16, line 28; page 16, lines 9-12; page 20, lines 13-20; page 23, lines 23-25; and Figures 1A-1F, 2, and 3). With regard to the precursor composition, the precursor composition includes one or more precursor compounds that each include A_x, one or more precursor compounds that each include B_x, and one or more precursor compounds that each include C_x, wherein each A is selected from the group of Zn, Cd, each B is selected from the group of Ga, In, each C is selected from the group Ge, Sn, Pb, each x is independently a non-zero number, and wherein each of A, B, and C are different from each other and from O. (Page 6, lines 1-30; page 7, line 19, through page 8, line 6; page 12, lines 11-25; page 15, line 19, through page 16, line 28; page 18, line 27, through page 19, line 3; and page 21, lines 1-33).

Independent claim 33 is argued together with dependent claims 34-41.

1. Claim 34 is a dependent claim from independent claim 33 and recites that the one or more precursor compounds includes one or more precursor compounds that include D_x, where each D is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each x is independently a non-zero number, and where each of A, B, C, and D are different. (Page 6, lines 1-30; page 7, line 19, through page 8, line 29; page 12, lines 11-25; page 15, line 19, through page 17, line 7; and page 20, line 22, through page 21, line 33).

2. Claim 35 is a dependent claim from dependent claim 34 and recites that the one or more precursor compounds includes one or more precursor compounds that include E_x, where each E is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each x is independently a non-zero number, and where each of A, B, C, D, and E are different. (Page 6, lines 1-30; page 7, line 19, through page 9, line 19; page 12, lines 11-25; page 15, line 19, through page 16, line 28; page 17, lines 9-20; and page 21, lines 1-33).

3. Claim 36 is a dependent claim from dependent claim 35 and recites that the one or more precursor compounds includes one or more precursor compounds that include F_x, where each F is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each x is independently a non-zero number, and where each of A, B, C, D, E, and F are different. (Page 6, lines 1-30; page 7, line 19, through page 10, line 10; page 12, lines 11-25; page 15, line 19, through page 16, line 28; page 17, lines 22-34; and page 21, lines 1-33).

4. Claim 37 is a dependent claim from dependent claim 36 and recites that the one or more precursor compounds includes one or more precursor compounds that include G_x, where each G is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each x is independently a non-zero number, and where each of A, B, C, D, E, F, and G are different. (Page 6, lines 1-30; page 7, line 19, through page 11, line 12; page 12, lines 11-25; page 15, line 19, through page 16, line 28; page 18, lines 1-14; and page 21, lines 1-33).

D. Independent claim 57

Independent claim 57 recites a semiconductor device including a drain electrode, a source electrode, a channel contacting the drain electrode and the source electrode, and a gate dielectric positioned between a gate electrode and the channel. (Page 3, line 1, through page 4, line 24; page 5, lines 21-25; page 12, lines 1-9; page 15, lines 5-7 and 15-17; page 16, lines 9-12; page 20, lines 13-20; page 23, lines 23-25; and Figures 1A-1F, 2, and 3). With regard to the channel, the channel includes one or more of a metal oxide including zinc-gallium-germanium, zinc-gallium-tin, zinc-gallium-lead, cadmium-gallium-germanium, cadmium-gallium-tin, cadmium-gallium-lead, zinc-indium-germanium, zinc-indium-tin, zinc-indium-lead, cadmium-indium-germanium, cadmium-indium-tin, and cadmium-indium-lead. (Page 6, lines 1-10; page 7, line 19, through page 8, line 6; page 11, lines 4-12; page 12, lines 11-25; page 15, lines 19-31; page 16, lines 21-28; and page 21, lines 1-33).

Independent claim 57 is argued together with dependent claims 58-67.

1. Claim 60 is a dependent claim from independent claim 57 and recites that the metal oxide includes one or more of zinc-gallium-germanium-tin oxide, cadmium-gallium-germanium-tin oxide, zinc-indium-germanium-tin oxide, cadmium-indium-germanium-tin oxide, zinc-gallium-germanium-lead oxide, cadmium-gallium-germanium-lead oxide, zinc-gallium-tin-lead oxide, cadmium-gallium-tin-lead oxide, zinc-indium-germanium-lead oxide, cadmium-indium-germanium-lead oxide, zinc-indium-tin-lead oxide, cadmium-indium-tin-lead oxide, zinc-gallium-indium-germanium oxide, cadmium-gallium-indium-germanium oxide, zinc-gallium-indium-tin oxide, cadmium-gallium-indium-tin oxide, zinc-gallium-indium-lead oxide cadmium-gallium-indium-lead oxide,

zinc-cadmium-gallium-germanium oxide, zinc-cadmium-gallium-tin oxide, zinc-cadmium-gallium-lead oxide, zinc-cadmium-indium-germanium oxide, zinc-cadmium-indium-tin oxide, zinc-cadmium-indium-lead oxide. (Page 6, lines 1-10; page 7, line 19, through page 8, line 29; page 11, lines 4-12; page 12, lines 11-25; page 15, lines 19-31; page 16, lines 21-28; and page 21, lines 1-33).

2. Claim 62 is a dependent claim from independent claim 57 and recites that the metal oxide includes one or more of zinc-cadmium-gallium-indium-germanium oxide, zinc-cadmium-gallium-indium-tin oxide, zinc-cadmium-gallium-indium-lead oxide, zinc-gallium-germanium-tin-lead oxide, zinc-indium-germanium-tin-lead oxide, cadmium-gallium-germanium-tin-lead oxide, cadmium-indium-germanium-tin-lead oxide, zinc-cadmium-gallium-germanium-tin oxide, zinc-cadmium-indium-germanium-tin oxide, zinc-cadmium-gallium-germanium-lead oxide, zinc-cadmium-indium-germanium-lead oxide, zinc-cadmium-gallium-tin-lead oxide, zinc-cadmium-indium-tin-lead oxide, zinc-gallium-indium-germanium-tin oxide, cadmium-gallium-indium-germanium-tin oxide, zinc-gallium-indium-germanium-lead oxide, cadmium-gallium-indium-germanium-lead oxide, zinc-gallium-indium-tin-lead oxide, cadmium-gallium-indium-tin-lead oxide. (Page 6, lines 1-10; page 7, line 19, through page 9, line 19; page 11, lines 4-12; page 12, lines 11-25; page 15, lines 19-31; page 16, lines 21-28; and page 21, lines 1-33).

3. Claim 64 is a dependent claim from independent claim 57 and recites that the metal oxide includes one or more of zinc-cadmium-gallium-indium-germanium-tin oxide, zinc-cadmium-gallium-indium-germanium-lead oxide, zinc-cadmium-gallium-indium-tin-lead oxide, zinc-cadmium-gallium-germanium-tin-

lead oxide, zinc-cadmium-indium-germanium-tin-lead oxide, zinc-gallium-indium-germanium-tin-lead oxide, cadmium-gallium-indium-germanium-tin-lead oxide. (Page 6, lines 1-10; page 7, line 19, through page 10, line 10; page 11, lines 4-12; page 12, lines 11-25; page 15, lines 19-31; page 16, lines 21-28; and page 21, lines 1-33).

4. Claim 66 is a dependent claim from independent claim 57 and recites that the metal oxide includes one or more of zinc-cadmium-gallium-indium-germanium-tin-lead oxide. (Page 6, lines 1-10; page 7, line 19, through page 11, line 12; page 12, lines 11-25; page 15, lines 19-31; page 16, lines 21-28; and page 21, lines 1-33).

E. Dependent claims 11 and 13

Claims 11 and 13 are argued together.

1. Claim 11 is a dependent claim from independent claim 1 and recites that the channel includes one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form. (Page 1, line 33, through page 2, line 1; page 11, lines 14-18 and lines 29-33; and page 21, line 18, through page 22, line 20).

2. Claim 13 is a dependent claim from independent claim 12 and recites that the means for a channel includes a means for forming one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form. (Page 1, line 33, through page 2, line 1; page 11, lines 14-18 and lines 29-33; and page 21, line 18, through page 22, line 20).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Whether or not claims 1-10, 12, 14, and 57-67 are unpatentable under 35 USC § 103(a) over Kawasaki et al. (EP 1134811) (Transistor And Semiconductor Device) in combination with Cillessen et al. (WO 97/06554) (Semiconductor Device Provided With Transparent Switching Element).

B. Whether or not claims 33-41 are unpatentable under 35 USC § 103(a) over Kawasaki et al. (EP 1134811) in combination with Cillessen et al. (WO 97/06554) in view of Official Notice.

C. Whether or not claims 11 and 13 are unpatentable under 35 USC § 103(a) over Kawasaki et al. (EP 1134811) in combination with Cillessen et al. (WO 97/06554) in view of Official Notice.

VII. ARGUMENT

A. Arguments against the rejections under 103(a) over the Kawasaki reference in combination with the Cillessen reference.

1. Arguments regarding claims 1-10, 12, 14, and 57-67.

a. **For claims 1, 2, 12, 14, and 57-59, the cited references do not describe, teach, or suggest each and every claimed element.**

Appellant submits that the Kawasaki reference appears to describe, "A channel layer 11 formed of a transparent semiconductor such as zinc oxide ZnO." (Abstract). Appellant submits that the Cillessen reference appears to describe various embodiments of a "semiconductor device having a transparent switching element". (Title). In contrast, Appellant believes that claims 1, 2, 12, 14, and 57-59 are distinguishable from the Kawasaki reference and the Cillessen reference for at least the following reasons.

With regard to independent claim 1, as previously presented, the claim recites in part:

> a channel contacting the drain electrode and the source electrode, wherein the channel includes one or more compounds of the formula $A_xB_xC_xO_x$, wherein each A is selected from the group of Zn, Cd, each B is selected from the group of Ga, In, each C is selected from the group Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and each of A, B, and C are different from each other and from O;

In the May 17, 2006, Final Office Action, the Examiner refers back to the December 13, 2005, first Office Action rejection, in which the Examiner stated (emphasis added), "Kawasaki et al. teach the channel layer comprises of ZnO but fail to teach that the channel layer further comprises Ga or In and Ge or Sn or Pb and Zn or Cd", (i.e., the seven elements, in addition to oxygen, that independent claim 1 recites as being included in the channel in one or more compounds of the formula $A_xB_xC_xO_x$). The Kawasaki reference does state, however, "ZnO doped with any one of group III elements (B, Al, Ga, In, Tl)," **where Kawasaki is describing a bipolar transistor**. (Col. 6, lines 49-50, emphasis added). **In addition, the Kawasaki reference also states "a transparent conductive material such as conductive ZnO is used, which is doped with any one of group III elements (B, Al, Ga, In, Tl), ..."as a transparent electrode used in a field effect transistor. (Col. 4, lines 14-17).** Kawasaki appears to describe a ZnO channel material and further appears to suggest doping ZnO with Ga or In or other group III element. Kawasaki does not appear to disclose forming a ternary compound of ZnGaO or ZnInO, insofar as the elements recited in the present application are concerned. As such, Kawasaki does not disclose any ternary

compounds, much less any of the quaternary compounds recited in independent claim 1, which recites, "wherein each A is selected from the group of Zn, Cd, each B is selected from the group of Ga, In, each C is selected from the group Ge, Sn, Pb, each O is atomic oxygen".

The Examiner went on to state in the Office Action (emphasis added), "Cillessen at al. teach the presence of Ga or In and Ge or Sn or Pb and Zn or Cd". (Page 2, lines 25-27, of Cillessen). The Cillessen reference states, "Preferably, the basic material comprises a covalent oxide of a metal from the group Sn, Zn, and In." (Page 2, lines 31-32, emphasis added). Cillessen goes on to state that "dopant atoms are attuned to the covalent oxides used. Dopant atoms such as Sb, F, or Cl may thus be used when SnO_2 is the covalent oxide, Sn dopant atoms for In_2O_3, and Ga dopant atoms for ZnO as the oxide." (Page 2, line 33, through page 3, line 1, emphasis added). By limiting the dopant possibilities to one element for ZnO (i.e., Ga), as contrasted to three possible dopant elements for SnO_2, Cillessen appears to limit the compounds containing Zn to consisting of three elements (i.e., ZnGaO). Cillessen discloses the binary oxides Ga_2O_3, Bi_2O_3, SnO_2, ZnO, Sb_2O_3, PbO, GeO_2, and In_2O_3, and states, "mixtures of these oxides or compounds formed from these oxides such as $GaInO_3$, $ZnGa_2O_4$, or $CdGa_2O_4$ may be used." (Page 7, lines 8-10). As just-stated, Cillessen only appears to disclose Cd as a component of the ternary oxide $CdGa_2O_4$.

The only quaternary compounds that are disclosed in the cited references are in Cillessen and they all can be represented by $Pb_xZr_xTi_xO_3$, none of which contain Zn or Cd from group A, or Ga or In from group B. Cillessen states, "An additional

advantage is obtained when the insulating layer comprises a ferromagnetic material" (e.g., Pb). (Page 3, lines 9-10, emphasis added). Cillessen goes on to state, "Preferably, lead-zirconium titanate is chosen". (Page 3, lines 12-13, emphasis added). Consequently, the only compounds containing four different elements are disclosed in Cillessen as being material for the insulating layer, which is comparable to the gate dielectric of the present application, rather than "a channel contacting the drain electrode and the source electrode", as recited in independent claim 1 of the present application.

Hence, for compounds usable in a channel, Cillessen only discloses three ternary oxides (i.e., $GaInO_3$, $ZnGa_2O_4$, and $CdGa_2O_4$). As such, Cillessen does not disclose any of the quaternary compounds made possible by independent claim 1 for "a channel contacting the drain electrode and the source electrode", "wherein each A is selected from the group of Zn, Cd, each B is selected from the group of Ga, In, each C is selected from the group Ge, Sn, Pb, each O is atomic oxygen".

In the alternative, if one were to conclude, despite the limitations stated in the specification, that the eight disclosed elements (i.e., Ga, Bi, Sn, Zn, Sb, Pb, Ge, and In) could be combined to form channel material containing three different representatives of the eight elements disclosed by Cillessen, the number of possible combinations in quaternary oxides would be 8 x 7 x 6 = 336. Cillessen not specifying any combinations with more than three of the disclosed elements leaves it up to the imagination of the inventor to formulate compounds combining four or more of the elements. In the present application, Appellant has recited twelve quaternary oxides (see claims 57 and 58) from the 336 that were undisclosed in the

Cillessen reference (i.e., less than 4% of the possible combinations).

Independent claim 12, as previously presented, recites in part:

> means for controlling current flow electrically coupled to the drain electrode and the source electrode, wherein the means for controlling current flow includes one or more compounds of the formula $A_xB_xC_xO_x$, wherein each A is selected from the group of Zn, Cd, each B is selected from the group of Ga, In, and each C is selected from the group of Ge, Sn, Pb;

In addition, independent claim 57, as originally presented, recites in part:

> a channel contacting the drain electrode and the source electrode, wherein the channel includes one or more of a metal oxide including zinc-gallium-germanium, zinc-gallium-tin, zinc-gallium-lead, cadmium-gallium-germanium, cadmium-gallium-tin, cadmium-gallium-lead, zinc-indium-germanium, zinc-indium-tin, zinc-indium-lead, cadmium-indium-germanium, cadmium-indium-tin, cadmium-indium-lead;

As shown by the above recitation of independent claim 57, the claim details the formulation of the twelve metal oxide compounds included in channels in which each A is selected from the group of Zn, Cd, each B is selected from the group of Ga, In, each C is selected from the group Ge, Sn, Pb, and each of A, B, and C are different from each other.

Regarding Appellant's claims 1-14, 33-41 (which will be discussed below), and 57-67, the Examiner stated in the Final Office Action that "a prior art reference is evaluated by what it suggests to one versed in the art, rather than by its specific disclosure. In re Bozek, 163 USPQ 545 (CCPA 1969)." The Examiner went on to state, "a reference is considered not only for what it expressly states, but for what it would reasonably have suggested to one of ordinary skill in the art. In re DeLisle, 160 USPQ (CCPA 1969)."

Appellant respectfully notes that the references cited by the Examiner come from 1969 decisions that are not presented in the "List of Decisions Cited" in the latest revision (October 2005) of the Eighth Edition of the MPEP. In contrast, Part I of section 2144.08 in the current MPEP states (emphasis added):

> When evaluating the scope of a claim, every limitation in the claim must be considered. See, e.g., *In re Ochiai*, 71 F.3d 1565, 1572, 37 USPQ2d 1127, 1133 (Fed. Cir. 1995). However the claimed invention may not be dissected into discrete elements to be analyzed in isolation, but must be considered as a whole.

Part II of MPEP 2144.08 is entitled, "Determine Whether The Claimed Species Or Subgenus Would Have Been Obvious To One of Ordinary Skill In The Pertinent Art At The Time The Invention Was Made". Part II states in part, "The fact that a claimed species or subgenus is encompassed by a prior art genus is not sufficient to establish a *prima facie* case of obviousness", relying upon, *In re Baird*, 16 F.3d 380, 382, 29 UDPQ2d 1550, 1552 (Fed. Cir. 1994). The second part goes on to state, "Federal Circuit has "decline[d] to extract from *Merck* [*& Co. v. Biocraft Laboratories Inc.*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir. 1989)] the rule that ... regardless of how broad, a disclosure of a chemical genus renders obvious any species that happens to fall within it."

Subsection 4 of part II of MPEP 2144.08 states in part, " "([A] *prima facie* case of unpatentability requires that the teachings of the prior art suggest *the claimed compounds* to a person of ordinary skill in the art." (emphasis in original))." *Deuel*, 51 F.3d 1552, 1557, 34 USPQ2d 1210, 1214 (Fed. Cir. 1989). Subsection 4 goes on the state, "The prior art must provide one of ordinary skill in the art the motivation to make the proposed molecular modifications needed to arrive at the

claimed compound." *In re Lalu*, 747 F.2d 703, 705, 223 USPQ 1257, 1258 (Fed. Cir. 1984). Relevant to the preceding statement is the section of MPEP 2143.01 entitled, "Fact That The Claimed Invention Is Within The Capabilities Of One Of Ordinary Skill In The Art Is Not Sufficient By Itself To Establish *Prima Facie* Obviousness". The section states in part, relying upon *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993) (emphasis added):

> A statement that modifications of the prior art to meet the claimed invention would have been " 'well within the ordinary skill of the art at the time the claimed invention was made' " because the references relied upon teach that all the aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references.

The just-cited MPEP section goes on to state that "The level of skill in the art cannot be relied upon to provide the suggestion to combine references." *Al-Site Corp. v. VSI Int'l Inc.*, 174 F.3d 1308, 50 USPQ2d 1161 (Fed. Cir. 1999).

As such, Appellant respectfully submits that assertions by the Examiner that "a prior art reference is evaluated by what it suggests to one versed in the art, rather than by its specific disclosure", and that "a reference is considered not only for what it expressly states, but for what it would reasonably have suggested to one of ordinary skill in the art", conflict with the current rules for patent examination, premised upon recent decisions, as documented in the latest revision of the Eighth Edition of the MPEP.

With regard to independent claims 1, 12, and 57, as well as those claims that depend therefrom, Appellant submits that the broad characterization of possible combinations of the eight disclosed elements in Cillessen, along with the narrow

range of ternary examples provided therein, in addition to the even more narrow range of compounds and elements disclosed by Kawasaki, does not render obvious to one of ordinary skill in the art the twelve combinations of elements in quaternary oxides made possible by independent claim 1 and elucidated by independent claim 57, as previously presented.

b. **For claims 3-10, and 60-67, the cited references do not describe, teach, or suggest each and every claimed element.**

With regard to dependent claims 3-10, and 60-67, as originally presented, the number of possible combinations in oxides containing one to eight of the eight elements disclosed by Cillessen not combined with itself is eight factorial (40,320). Claims 3-4 recite the formula $A_xB_XC_xD_xO_x$, whereas claim 60 recites the possible formulations of such quintenary compounds; claims 5-6 recite the formula $A_xB_XC_xD_xE_xO_x$, whereas claim 62 recites the possible formulations of such sextanary compounds; claims 7-8 recite the formula $A_xB_XC_xD_xE_xF_xO_x$, whereas claim 64 recites the possible formulations of such septanary compounds; and claims 9-10 recite the formula $A_xB_XC_xD_xE_xF_xG_xO_x$, whereas claim 66 recites the one possible formulation of such an octanary compound.

Using the two possible elements for A (Zn, Cd), the two possible elements for B (Ga, In), the three possible elements for C (Ge, Sn, Pb), and all seven possible elements for D-G (Zn, Cd, Ga, In, Ge, Sn, Pb), and taking into account that A, B, C, D, E, F, and G must be different elements, a limited number of multicomponent oxides can be formulated. Accordingly, $A_xB_XC_xD_xO_x$ can be formulated in 24 different combinations of the elements (see claim 60), $A_xB_XC_xD_xE_xO_x$ can be

formulated in 19 different combinations of the elements (see claim 62), $A_xB_XC_xD_xE_xF_xO_x$ can be formulated in 7 different combinations of the elements (see claim 64), and $A_xB_XC_xD_xE_xF_xG_xO_x$ can be formulated in one combination of the elements (see claim 66).

As a result, in addition to the twelve quaternary oxides, Appellant is claiming a specific 51 combinations of quintenary, sextanary, septanary, and octanary oxides using seven elements from the 40,320 possible combinations of eight elements (i.e., less than 0.15% of the possible combinations) disclosed by Cillessen. Moreover, Cillessen does not disclose any specific quintenary, sextanery, septanary, and octanary oxides formulated from the disclosed eight elements.

With regard to dependent claims 3-10, and 60-67, as originally presented, Appellant submits that Kawasaki and Cillessen do not by stating lists of elements and disclosing limited numbers of binary and ternary oxides, although specifying no compounds for the channel that contain more than two from the list in combination with oxygen, make obvious to one of ordinary skill in the art the specific multicomponent oxide compounds containing four, five, six, and seven different listed elements that are made possible by, or are elucidated by, dependent claims of the present application.

As such, for at least the reasons provided above, the Kawasaki reference and the Cillessen reference, either individually or in combination, do not describe, teach, or suggest each and every element of Appellant's independent claims 1, 12, and 57, as previously presented. Nor do Kawasaki and Cillesen describe, teach, or suggest each and every element of dependent claims 3-10, and 60-67, as originally

presented. Accordingly, Appellant respectfully requests reconsideration and withdrawal of the 103(a) rejection of independent claims 1, 12, and 57, as well as those claims that depend therefrom.

B. Arguments against the rejections under 103(a) over the Kawasaki reference in combination with the Cillessen reference in view of Official Notice.

1. Arguments regarding claims 33-41.

a. **For claims 33, and 38-41, the cited references and Official Notice do not describe, teach, or suggest each and every claimed element.**

In addition to the reasons provided above, Appellant believes that claims 33, and 38-41, are patentably distinct from the Kawasaki and Cillessen references and the Official Notice for at least the following reasons.

With regard to independent claim 33, as previously presented, the claim recites in part:

> providing a precursor oxide composition including one or more precursor compounds that each include A_x, one or more precursor compounds that each include B_x, and one or more precursor compounds that each include C_x, wherein each A is selected from the group of Zn, Cd, each B is selected from the group of Ga, In, each C is selected from the group Ge, Sn, Pb, each x is independently a non-zero number, and wherein each of A, B, and C are different from each other and from O;

In the May 17, 2006, Final Office Action, the Examiner refers back to the December 13, 2005, first Office Action rejection, in which the Examiner stated, "Kawasaki et al. in combination with Cillessen et al. teach the recited device." The Examiner went on to apparently take Official Notice by stating that "how the device is formed has not been given patentability weight because the invention is directed

to a device." To support the preceding statement, the Examiner was seemingly relying on MPEP section 2113 relating to product-by-process claims. The Examiner's rationale for rejecting independent claim 33, and those claims depending therefrom, apparently is derived from *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985), which states, in relevant part, "If the product in a product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process."

As discussed above with regard to independent claims 1, 12, and 57, Appellant respectfully submits that the Kawasaki and Cillessen references do not disclose "wherein each A is selected from the group of Zn, Cd, each B is selected from the group of Ga, In, each C is selected from the group Ge, Sn, Pb, each x is independently a non-zero number, and wherein each of A, B, and C are different from each other and from O", as recited in part in independent claims 1 and 33, as previously presented. Appellant respectfully submits that the Official Notice does not cure the deficiencies of the Kawasaki and Cillessen references. As a result, the final product of independent claim 33 is not made obvious by Kawasaki and Cillessen, either individually or in combination, and the failure of Kawasaki and Cillessen to describe, teach, or suggest "how the device is formed" (i.e., the step of "providing a precursor oxide composition", as recited in independent claim 33, as previously presented) becomes relevant as another element distinguishing the present disclosure from Kawasaki and Cillessen.

As such, the Kawasaki and Cillessen references, in view of the Official

Notice, either independently or in combination, do not describe, teach, or suggest each and every element in Appellant's independent claim 33, as previously presented. Accordingly, Appellant respectfully requests reconsideration and withdrawal of the 103(a) rejection of independent claim 33, as previously presented, as well as of claims that depend therefrom.

b. **For claims 34-37, the cited references and Official Notice do not describe, teach, or suggest each and every claimed element.**

In addition to the reasons provided above, Appellant believes that claims 34-37 are patentably distinct from the Kawasaki and Cillessen references and the Official Notice for at least the following reasons.

With regard to dependent claim 34-37, as previously presented, Appellant respectfully submits that the Kawasaki reference and the Cillessen reference do not disclose, either individually or in combination, any specific quintenary, sextanery, septanary, and octanary oxides formulated from the disclosed eight elements. Hence, the specified manner of formulating quintenary, sextanery, septanary, and octanary oxides using seven of the disclosed eight elements, as recited in dependent claims 34-37, is not made obvious by the cited references.

Because the quintenary, sextanery, septanary, and octanary oxides recited in the present disclosure are not made obvious by the Kawasaki and Cillessen references, Appellant respectfully submits that the Official Notice does not cure the deficiencies of the Kawasaki and Cillessen references.

As such, the Kawasaki and Cillessen references, in view of the Official Notice, either independently or in combination, do not describe, teach, or suggest

each and every element in Appellant's dependent claims 34-37, as previously presented. Accordingly, Appellant respectfully requests reconsideration and withdrawal of the 103(a) rejection of dependent claims 34-37, as previously presented, as well as of claims that depend therefrom.

C. Arguments against the rejections under 103(a) over the Kawasaki reference in combination with the Cillessen reference in view of Official Notice.

1. Arguments regarding dependent claims 11 and 13.

a. **For dependent claims 11 and 13, the cited references and Official Notice do not describe, teach, or suggest each and every claimed element.**

In addition to the reasons provided above, Appellant believes that the claims 11 and 13 are patentably distinct from the Kawasaki and Cillessen references and the Official Notice for at least the following reasons.

Claim 11, as originally presented, is a dependent claim from independent claim 1 and recites in part, "wherein the channel includes one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form." The Examiner stated in the first Office Action, "Kawasaki et al. in combination with Cillessen et al. appear to fail to teach the channel comprises of an amorphous form or single-phase crystalline form material." The Examiner went on to state, "However, the use of amorphous or single-phase crystalline form material as channel is well-known."

Part A of MPEP section 2144.03 states (emphasis added), "Official notice unsupported by documentary evidence should only be taken by the examiner where

the facts asserted to be well-known, or to be common knowledge in the art are capable of instant and unquestionable demonstration as being well-known." Part A supports this statement by stating (emphasis added):

> As noted by the court in *In re Ahlert*, 424 F.2d 1088, 1091, 165 USPQ 418, 420 (CCPA 1970), the notice of facts beyond the record which may be taken by the examiner must be "capable of such instant and unquestionable demonstration as to defy dispute."

Claim 13, as originally presented, is a dependent claim from independent claim 12 and recites, "wherein the means for a channel includes a means for forming one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form."

The Examiner stated in the first Office Action that the use of amorphous or single-phase crystalline form material as a channel is well-known. Appellant respectfully submits that a "channel", as recited in dependent claim 11, or a "means for a channel includes a means for forming one", as recited in dependent claim 13, is difficult to prepare in an amorphous form and, therefore, is not commonly done, regardless of whether the metal oxides are as simple as ZnO, as disclosed in Kawasaki, or as complex as $A_xB_XC_xD_xE_x F_xG_xO_x$, as recited in the present application. As such, Appellant respectfully submits that utilizing one or more compounds of the formula $A_xB_xC_xO_x$ in amorphous form is "not capable of instant and unquestionable demonstration as being well-known", as required by MPEP section 2144.03 when an Examiner takes Official Notice without being "supported by citation to some reference work recognized as a standard in the pertinent art". If rejection of claims 11 and 13 pursuant to Official Notice is sustained, Appellant

respectfully requests that a citation be provided that is to "some reference work recognized as a standard in the pertinent art", the pertinent art being formation of channels from metal oxides in semiconductor devices.

As such, Appellant respectfully submits that the Kawasaki and Cillessen references in view of the Official Notice, either independently or in combination, do not describe, teach, or suggest each and every element in dependent claims 11 and 13, as originally presented. Accordingly, Appellant respectfully requests reconsideration and withdrawal of the 103(a) rejection of dependent claims 11 and 13, as originally presented.

In the alternative, claims 11 and 13 are dependent claims from independent claims 1 and 12, respectively. As described above, Appellant respectfully submits that independent claims 1 and 12, as previously presented, are in condition for allowance. From Appellant's review of the Official Notice, the Official Notice does not cure the deficiencies of the Kawasaki and Cillessen references. That is, the Official Notice does not describe, teach, or suggest each and every element of independent claims 1 and 12, as previously presented. Accordingly, Appellant respectfully requests reconsideration and withdrawal of the 103(a) rejection of dependent claims 11 and 13, as originally presented.

CONCLUSION

Appellant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner and/or members of the Board are invited to telephone Appellant's attorney Donald J. Coulman at (541) 715-1694 to facilitate this appeal.

At any time during the pendency of this application, please charge any additional fees or credit overpayment to the Deposit Account No. 08-2025.

CERTIFICATE UNDER 37 C.F.R. §1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: **MS APPEAL BRIEF-PATENTS** Commissioner for Patents, P.O. BOX 1450, Alexandria, VA 22313-1450, on this 26th day of July, 2006.

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VIII. CLAIMS APPENDIX

1. (Previously Presented) A semiconductor device, comprising:

a drain electrode;

a source electrode;

a channel contacting the drain electrode and the source electrode, wherein the channel includes one or more compounds of the formula $A_xB_xC_xO_x$, wherein each A is selected from the group of Zn, Cd, each B is selected from the group of Ga, In, each C is selected from the group Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and each of A, B, and C are different from each other and from O; and

a gate dielectric positioned between a gate electrode and the channel.

2. (Original) The semiconductor device of claim 1, wherein the one or more compounds of the formula $A_xB_xC_xO_x$ includes a ratio of A:B:C, wherein A, B, and C are each in a range of about 0.025 to about 0.95.

3. (Previously Presented) The semiconductor device of claim 1, wherein the one or more compounds of the formula $A_xB_xC_xO_x$ includes D_x, to form a compound of the formula $A_xB_xC_xD_xO_x$, wherein each D is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and wherein each of A, B, C, and D are different.

4. (Previously Presented) The semiconductor device of claim 3, wherein the one or more compounds of the formula $A_xB_xC_xD_xO_x$ includes a ratio of A:B:C:D, wherein A, B, C, and D are each in a range of about 0.017 to about 0.95.

5. (Previously Presented) The semiconductor device of claim 3, wherein the one or more compounds of formula $A_xB_xC_xD_xO_x$ includes E_x, to form a compound of the formula $A_xB_xC_xD_xE_xO_x$, wherein each E is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and wherein each of A, B, C, D, and E are different.

6. (Original) The semiconductor device of claim 5, wherein the one or more compounds of the formula $A_xB_xC_xD_xE_xO_x$ includes a ratio of A:B:C:D:E, wherein A, B, C, D, and E are each in a range of about 0.013 to about 0.95.

7. (Original) The semiconductor device of claim 5, wherein the one or more compounds of formula $A_xB_xC_xD_xE_xO_x$ includes F_x, to form a compound of the formula $A_xB_xC_xD_xE_xF_xO_x$, wherein each F is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb,, each O is atomic oxygen, each x is independently a non-zero integer, and wherein each of A, B, C, D, E, and F are different.

8. (Original) The semiconductor device of claim 7, wherein the one or more compounds of the formula $A_xB_xC_xD_xE_xF_xO_x$ includes a ratio of A:B:C:D:E:F, wherein A, B, C, D, E, and F are each in a range of about 0.01 to about 0.95.

9. (Previously Presented) The semiconductor device of claim 7, wherein the one or more compounds of the formula $A_xB_xC_xD_xE_xF_xO_x$, includes G_x, to form a compound of the formula $A_xB_xC_xD_xE_xF_xG_xO_x$, wherein each G is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb,, each O is atomic oxygen, each x is independently a non-zero number, and wherein each of A, B, C, D, E, F, and G are different.

10. (Original) The semiconductor device of claim 9, wherein the one or more compounds of the formula $A_xB_xC_xD_xE_xF_xG_xO_x$ includes a ratio of A:B:C:D:E:F:G, wherein A, B, C, D, E, F, and G are each in a range of about 0.0085 to about 0.95.

11. (Original) The semiconductor device of claim 1, wherein the channel includes one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form.

12. (Previously Presented) A semiconductor device, comprising:

a drain electrode;

a source electrode;

means for controlling current flow electrically coupled to the drain electrode and the source electrode, wherein the means for controlling current flow includes one or more compounds of the formula $A_xB_xC_xO_x$, wherein each A is selected from the group of Zn, Cd, each B is selected from the group of Ga, In, and each C is selected from the group of Ge, Sn, Pb; and

a gate electrode separated from the channel by a gate dielectric.

13. (Original) The semiconductor device of claim 12, wherein the means for a channel includes a means for forming one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form.

14. (Original) The semiconductor device of claim 12, wherein the source, drain, and gate electrodes include a substantially transparent material.

15. (Withdrawn) A method of forming a channel, comprising:

providing at least one precursor composition including one or more precursor compounds that include A_x, one or more precursor compounds that include B_x, and one or more precursor compounds that include C_x, wherein each A is selected from the group of Zn, Cd, each B is selected from the group of Ga, In, each C is selected from the group Ge, Sn, Pb, each x is independently a non-zero integer, and wherein each of A, B, and C are different; and

depositing the channel including the precursor composition to form a multicomponent oxide from the precursor composition to electrically couple a drain electrode and a source electrode.

16. (Withdrawn) The method of claim 15, including providing a substrate or substrate assembly; and

forming the semiconductor device on the substrate or substrate assembly.

17. (Withdrawn) The method of claim 15, wherein depositing the channel includes depositing one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form.

18. (Withdrawn) The method of claim 15, wherein the precursor composition includes a liquid form.

19. (Withdrawn) The method of claim 18, wherein depositing the channel includes an ink-jet deposition technique when the precursor composition includes the liquid form.

20. (Withdrawn) The method of claim 15, wherein the one or more precursor compounds includes one or more precursor compounds that include D_x, wherein each D is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb each x is independently a non-zero integer, and wherein each of A, B, C, and D are different.

21. (Withdrawn) The method of claim 20, wherein the one or more precursor compounds includes one or more precursor compounds that include E_x, wherein each E is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb each x is independently a non-zero integer, and wherein each of A, B, C, D, and E are different.

22. (Withdrawn) The method of claim 21, wherein the one or more precursor compounds includes one or more precursor compounds that include F_x, wherein each F is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb each x is independently a non-zero integer, and wherein each of A, B, C, D, E, and F are different.

23. (Withdrawn) The method of claim 22, wherein the one or more precursor compounds includes one or more precursor compounds that include G_x, wherein each G is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each x is independently a non-zero integer, and wherein each of A, B, C, D, E, F, and G are different.

24. (Withdrawn) The method of claim 23, wherein depositing a channel includes a step for vaporizing the precursor composition to form a vaporized precursor composition, and depositing the vaporized precursor composition using a physical

vapor deposition technique including one or more of dc reactive sputtering, rf sputtering, magnetron sputtering, ion beam sputtering.

25. (Withdrawn) A method of manufacturing a semiconductor device, comprising:

providing a drain electrode;

providing a source electrode;

a step for providing a precursor composition including one or more precursor compounds that include A_x, one or more precursor compounds that include B_x, and one or more precursor compounds that include C_x, wherein each A is selected from the group of Zn, Cd, each B is selected from the group of Ga, In, each C is selected from the group Ge, Sn, Pb, each x is independently a non-zero integer, and wherein each of A, B, and C are different;

a step for depositing a channel including depositing the precursor composition to form a multicomponent oxide from the precursor composition to electrically couple the drain electrode and the source electrode;

providing a gate electrode; and

providing a gate dielectric positioned between the gate electrode and the channel.

26. (Withdrawn) The method of claim 25, wherein the step for depositing a channel includes a step for vaporizing the precursor composition to form a vaporized precursor composition, and depositing the vaporized precursor

composition using a physical vapor deposition technique including one or more of dc reactive sputtering, rf sputtering, magnetron sputtering, ion beam sputtering.

27. (Withdrawn) The method of claim 25, wherein the step for depositing a channel includes an ink-jet deposition technique.

28. (Withdrawn) The method of claim 25, wherein providing the source, the drain, and the gate electrodes includes providing a substantially transparent form of the source, the drain, and the gate electrodes.

29. (Withdrawn) The method of claim 25, wherein the one or more precursor compounds includes one or more precursor compounds that include D_x, wherein each D is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each x is independently a non-zero integer, and wherein each of A, B, C, and D are different.

30. (Withdrawn) The method of claim 29, wherein the one or more precursor compounds includes one or more precursor compounds that include E_x, wherein each E is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each x is independently a non-zero integer, and wherein each of A, B, C, D, and E are different.

31. (Withdrawn) The method of claim 30, wherein the one or more precursor compounds includes one or more precursor compounds that include F_x, wherein

each F is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each x is independently a non-zero integer, and wherein each of A, B, C, D, E, and F are different.

32. (Withdrawn) The method of claim 31, wherein the one or more precursor compounds includes one or more precursor compounds that include G_x, wherein each G is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each x is independently a non-zero integer, and wherein each of A, B, C, D, E, F, and G are different.

33. (Previously Presented) A semiconductor device formed by the steps, comprising:

providing a drain electrode;

providing a source electrode;

providing a precursor oxide composition including one or more precursor compounds that each include A_x, one or more precursor compounds that each include B_x, and one or more precursor compounds that each include C_x, wherein each A is selected from the group of Zn, Cd, each B is selected from the group of Ga, In, each C is selected from the group Ge, Sn, Pb, each x is independently a non-zero number, and wherein each of A, B, and C are different from each other and from O;

depositing a channel including the precursor composition to form a multicomponent oxide including $A_xB_xC_xO_x$ from the precursor composition to electrically couple the drain electrode and the source electrode;

providing a gate electrode; and

providing a gate dielectric positioned between the gate electrode and the channel.

34. (Previously Presented) The semiconductor device of claim 33, wherein the one or more precursor compounds includes one or more precursor compounds that include D_x, wherein each D is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each x is independently a non-zero number, and wherein each of A, B, C, and D are different.

35. (Previously Presented) The semiconductor device of claim 34, wherein the one or more precursor compounds includes one or more precursor compounds that include E_x, wherein each E is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each x is independently a non-zero number, and wherein each of A, B, C, D, and E are different.

36. (Previously Presented) The semiconductor device of claim 35, wherein the one or more precursor compounds includes one or more precursor compounds that include F_x, wherein each F is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb,

each x is independently a non-zero number, and wherein each of A, B, C, D, E, and F are different.

37. (Previously Presented) The semiconductor device of claim 36, wherein the one or more precursor compounds includes one or more precursor compounds that include G_x, wherein each G is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each x is independently a non-zero number, and wherein each of A, B, C, D, E, F, and G are different.

38. (Original) The semiconductor device of claim 37, wherein depositing the channel includes vaporizing the precursor composition to form a vaporized precursor composition, and depositing the vaporized precursor composition using a physical vapor deposition technique including one or more of dc reactive sputtering, rf sputtering, magnetron sputtering, ion beam sputtering.

39. (Original) The semiconductor device of claim 33, wherein providing the source, the drain, and the gate electrodes includes providing a substantially transparent form of the source, the drain, and the gate electrodes.

40. (Original) The semiconductor device of claim 33, wherein providing the precursor composition includes providing a liquid form of the precursor composition.

41. (Original) The semiconductor device of claim 40, wherein depositing the channel includes an ink-jet deposition technique when the precursor composition includes the liquid form.

42. (Withdrawn) A method for operating a semiconductor device, comprising:

providing a semiconductor device that includes a source electrode, a drain electrode, and a channel to electrically couple the source electrode and the drain electrode, a gate electrode separated from the channel by a gate dielectric, wherein the channel includes a multicomponent oxide selected from at least one metal cation from group 12, at least one metal cation from group 13, and at least one metal cation from group 14, wherein group 12 cations include Zn and Cd, group 13 cations include Ga and In, group 14 cations include Ge, Sn, and Pb, wherein each component in the multicomponent oxide is different; and

applying a voltage to the gate electrode to effect a flow of electrons through the channel.

43. (Withdrawn) The method of claim 42, wherein operating the semiconductor device includes using the semiconductor device as a switch in a display device.

44. (Withdrawn) The method of claim 42, wherein operating the semiconductor device includes conducting electrons through the channel in a linear region of operation.

45. (Withdrawn) A display device, comprising:

a plurality of pixel devices configured to operate collectively to display images, where each of the pixel devices includes a semiconductor device configured to control light emitted by the pixel device, the semiconductor device including:

a drain electrode;

a source electrode;

a channel contacting the drain electrode and the source electrode, wherein the channel includes one or more compounds of the formula $A_xB_xC_xO_x$, wherein each A is selected from the group of Zn, Cd, each B is selected from the group of Ga, In, each C is selected from the group Ge, Sn, Pb, each O is atomic oxygen; each x is independently a non-zero integer, and wherein each of A, B, and C are different;

a gate electrode; and

a gate dielectric positioned between the gate electrode and the channel and configured to permit application of an electric field to the channel.

46. (Withdrawn) The display of claim 45, wherein the one or more compounds of the formula $A_xB_xC_xO_x$ includes an atomic composition of ratio A:B:C, wherein A, B, and C are each in a range of about 0.025 to about 0.95.

47. (Withdrawn) The display of claim 45, wherein the source, the drain, and the gate electrodes include a substantially transparent material.

48. (Withdrawn) The display of claim 45, wherein the one or more compounds of the formula $A_xB_xC_xO_x$ includes D_x, to form a compound of the formula $A_xB_xC_xD_xO_x$, wherein each D is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero integer, and wherein each of A, B, C, and D are different.

49. (Withdrawn) The display of claim 48, wherein the one or more compounds of the formula $A_xB_xC_xD_xO_x$ includes an atomic composition of ratio A:B:C:D, wherein A, B, C, and D are each in a range of about 0.017 to about 0.95.

50. (Withdrawn) The display of claim 48, wherein the one or more compounds of formula $A_xB_xC_x$ D_xO_x includes E_x to form a compound of the formula $A_xB_xC_xD_xE_xO_x$, wherein each E is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero integer, and wherein each of A, B, C, D, and E are different.

51. (Withdrawn) The display of claim 50, wherein the one or more compounds of the formula $A_xB_xC_xD_xE_xO_x$ includes an atomic composition of ratio A:B:C:D:E, wherein A, B, C, D, and E are each in a range of about 0.013 to about 0.95.

52. (Withdrawn) The display of claim 50, wherein the one or more compounds of formula $A_xB_xC_x$ $D_xE_xO_x$ includes F_x to form a compound of the formula $A_xB_xC_xD_xE_xF_xO_x$, wherein each F is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero integer, and wherein each of A, B, C, D, E, and F are different.

53. (Withdrawn) The display of claim 52, wherein the one or more compounds of the formula $A_xB_xC_xD_xE_xF_xO_x$ includes an atomic composition of ratio A:B:C:D:E:F, wherein A, B, C, D, E, and F are each in a range of about 0.01 to about 0.95.

54. (Withdrawn) The display of claim 52, wherein the one or more compounds of the formula $A_xB_xC_xD_xE_xF_xO_x$, includes G_x to form a compound of the formula $A_xB_xC_xD_xE_xF_x$ G_xO_x, wherein each G is selected from the group of Zn, Cd, Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero integer, and wherein each of A, B, C, D, E, F, and G are different.

55. (Withdrawn) The display of claim 54, wherein the one or more compounds of the formula $A_xB_xC_xD_xE_xF_xG_xO_x$ includes an atomic composition of ratio A:B:C:D:E:F:G, wherein A, B, C, D, E, F, and G are each in a range of about 0.0085 to about 0.95.

56. (Withdrawn) The display of claim 56, wherein the channel includes one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form.

57. (Original) A semiconductor device, comprising:

a drain electrode;

a source electrode;

a channel contacting the drain electrode and the source electrode, wherein the channel includes one or more of a metal oxide including zinc-gallium-germanium, zinc-gallium-tin, zinc-gallium-lead, cadmium-gallium-germanium, cadmium-gallium-tin, cadmium-gallium-lead, zinc-indium-germanium, zinc-indium-tin, zinc-indium-lead, cadmium-indium-germanium, cadmium-indium-tin, cadmium-indium-lead; and

a gate dielectric positioned between the gate electrode and the channel.

58. (Original) The semiconductor device of claim 57, wherein the metal oxide includes one or more of zinc-gallium-germanium-oxide, zinc-gallium-tin-oxide, zinc-gallium-lead-oxide, cadmium-gallium-germanium-oxide, cadmium-gallium-tin-oxide, cadmium-gallium-lead-oxide, zinc-indium-germanium-oxide, zinc-indium-tin-oxide, zinc-indium-lead-oxide, cadmium-indium-germanium-oxide, cadmium-indium-tin-oxide, cadmium-indium-lead-oxide.

59. (Original) The semiconductor device of claim 58, wherein the metal oxide includes an atomic composition of A:B:C, wherein A, B, and C are each in a range of about 0.025 to about 0.95.

60. (Original) The semiconductor device of claim 57, wherein the metal oxide includes one or more of zinc-gallium-germanium-tin oxide, cadmium-gallium-germanium-tin oxide, zinc-indium-germanium-tin oxide, cadmium-indium-germanium-tin oxide, zinc-gallium-germanium-lead oxide, cadmium-gallium-germanium-lead oxide, zinc-gallium-tin-lead oxide, cadmium-gallium-tin-lead oxide, zinc-indium-germanium-lead oxide, cadmium-indium-germanium-lead oxide, zinc-indium-tin-lead oxide, cadmium-indium-tin-lead oxide, zinc-gallium-indium-germanium oxide, cadmium-gallium-indium-germanium oxide, zinc-gallium-indium-tin oxide, cadmium-gallium-indium-tin oxide, zinc-gallium-indium-lead oxide cadmium-gallium-indium-lead oxide, zinc-cadmium-gallium-germanium oxide, zinc-cadmium-gallium-tin oxide, zinc-cadmium-gallium-lead oxide, zinc-cadmium-indium-germanium oxide, zinc-cadmium-indium-tin oxide, zinc-cadmium-indium-lead oxide.

61. (Original) The semiconductor device of claim 60, wherein the metal oxide includes an atomic composition of A:B:C:D, wherein A, B, C, and D are each in a range of about 0.017 to about 0.95.

62 (Original) The semiconductor device of claim 57, wherein the metal oxide includes one or more of zinc-cadmium-gallium-indium-germanium oxide, zinc-cadmium-gallium-indium-tin oxide, zinc-cadmium-gallium-indium-lead oxide, zinc-gallium-germanium-tin-lead oxide, zinc-indium-germanium-tin-lead oxide, cadmium-gallium-germanium-tin-lead oxide, cadmium-indium-germanium-tin-lead oxide, zinc-cadmium-gallium-germanium-tin oxide, zinc-cadmium-indium-germanium-tin oxide, zinc-cadmium-gallium-germanium-lead oxide, zinc-cadmium-indium-germanium-lead oxide, zinc-cadmium-gallium-tin-lead oxide, zinc-cadmium-indium-tin-lead oxide, zinc-gallium-indium-germanium-tin oxide, cadmium-gallium-indium-germanium-tin oxide, zinc-gallium-indium-germanium-lead oxide, cadmium-gallium-indium-germanium-lead oxide, zinc-gallium-indium-tin-lead oxide, cadmium-gallium-indium-tin-lead oxide.

63. (Original) The semiconductor device of claim 62, wherein the metal oxide includes an atomic composition of A:B:C:D:E, wherein A, B, C, D, and E are each in a range of about 0.013 to about 0.95.

64. (Original) The semiconductor device of claim 57, wherein the metal oxide includes one or more of zinc-cadmium-gallium-indium-germanium-tin oxide, zinc-cadmium-gallium-indium-germanium-lead oxide, zinc-cadmium-gallium-indium-tin-lead oxide, zinc-cadmium-gallium-germanium-tin-lead oxide, zinc-cadmium-indium-germanium-tin-lead oxide, zinc-gallium-indium-germanium-tin-lead oxide, cadmium-gallium-indium-germanium-tin-lead oxide.

65. (Original) The semiconductor device of claim 64, wherein the metal oxide includes an atomic composition of A:B:C:D:E:F, wherein A, B, C, D, E, and F are each in a range of about 0.01 to about 0.95.

66. (Original) The semiconductor device of claim 57, wherein the metal oxide includes one or more of zinc-cadmium-gallium-indium-germanium-tin-lead oxide.

67. (Original) The semiconductor device of claim 66, wherein the metal oxide includes an atomic composition of A:B:C:D:E:F:G, wherein A, B, C, D, E, F, and G are each in a range of about 0.0085 to about 0.95.

IX. EVIDENCE APPENDIX

None

X. RELATED PROCEEDINGS APPENDIX

Appellant submits that no copies currently exist of decisions rendered by a court or the Board in any proceeding identified pursuant to paragraph (c)(1)(ii) of section 41.37 with regard to Application Number 10/799,838, Application Number 10/799,325, and Application Number 10/799/961.